MANIFOLD SENSOR RETENTION SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH

[0002] Not applicable.

BACKGROUND OF THE INVENTION

Field of the Invention

[0003] The invention relates to a system for fluidly connecting and retaining a sensor to an intake manifold of an internal combustion engine.

Description of Related Art

[0004] Internal combustion engines have an intake manifold. The intake manifold can be formed of any of a number of materials, such as aluminum, but today are more commonly injection molded from a plastic or other composite material.

[0005] These composite materials have the advantage of light weight, low cost, and sufficient tensile strength for withstanding the normal loads imposed upon them. A disadvantage lies, however, in their ability to withstand the fine shearing forces created in bolting components directly to the composite, as in forming or tapping threads in the composite that must withstand bolt tightening torque. This weakness of composites has traditionally been overcome by the use of internally threaded metallic sleeves, press-fit into wells or apertures formed in the surface of the molded part. The attached components are then attached to the molded part with fasteners threaded into the metallic sleeves, or the component itself has external threads for mating with the sleeve.

[0006] These methods also have a percentage of failures as the press-fit sleeve sometimes breaks loose of the molded part, coming completely loose or at least causing a leak. In some applications, an attached component requiring a sealing connection with the molded part is attached to the manifold with fasteners on each side of the component. Uneven or sideways forces on the connectors can cause the seal between the attached component and the molded part to leak. So, while this method can overcome the weakness of the molded part in retaining attached components, it also introduces other failure modes. It also weighs against the advantage found in the lower weight, and, especially, the lower cost of the single injection molded part.

[0007] It would therefore be advantageous to develop an alternative method of attaching components to an injection molded part, such as an intake manifold. Such a method would take advantage of the flexibility of injection molding, and would avoid the requirement for additional fixtures for securely but removably attaching components to the injection molded part. This method would also avail a sealing attachment of such components to the molded part. This method would also be adaptable to a part formed or machined by a method other than injection molding.

BRIEF SUMMARY OF THE INVENTION

[0008] In combination, an attachment and a receiving attachment port, the configuration of the attachment port in the injection molded intake manifold of an internal combustion engine, the port including a pass through cylindrical aperture, at least one inwardly projecting lug in the aperture, the port being surrounded on the external surface of the manifold by a plurality of projections for aligning the attachment for insertion into the port, and preventing inadvertent removal from the port, the attachment including at least one externally projecting lug for cooperating with the internally projecting lug of the port for positively locking the attachment within the port.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

[0009] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

[0010] Figure 1 is a perspective view of a reception port of a manifold sensor retention system according to the invention.

[0011] Figure 2 is a plan view of reception port of Figure 1.

[0012] Figure 3 is a perspective view of a sensor for insertion into the reception port of Figures 1-2.

[0013] Figure 4 is a perspective view of the sensor of Figure 3 poised for insertion into the reception port of Figures 1-2.

[0014] Figure 5 is a perspective view of the sensor of Figure 3 in the reception port in an insertion orientation.

[0015] Figure 6 is a perspective view of the sensor and reception port of Figure 5, the sensor being rotated to a locked orientation.

[0016] Figure 7 is a plan view of the sensor and reception port of Figure 6.

[0017] Figure 8 is a perspective view of the sensor and reception of Figures 6-7, with an external wire connector attached to the sensor.

DETAILED DESCRIPTION OF THE INVENTION

[0018] Referring to Figures 1-4, a manifold sensor retention system 10 is comprised of a reception port 110 formed in the manifold 100, and a sensor 200 configured for mounting with the sensor port 110.

[0019] With particular reference to Figures 1-2, port 110 is generally cylindrical and extends from the face of the manifold 100. Port 110 has a flat external surface 116. The inner cylindrical surface of port 110 includes a pair of inwardly extending lugs 112, 114 (see Figure 2). In the illustrated embodiment, the lugs 112, 114 are diametrically opposed and each occupy approximately 90 degrees of the circumference of the cylindrical surface, having a 90 degree separation therebetween. A pair of pillars 150 are formed on either side of port 110, having a formed aperture 152, for securing a sensor with external fasteners according to the prior art. The formed manifold 100 is thus adaptable to accepting a sensor 200 according to the invention, or a conventional sensor according to the prior art.

[0020] A raised first insertion guide 120 is formed on one side of port 110. First insertion guide 120 is formed integrally and extends above the flat external surface 116 of port 110. A second insertion guide/removal stop 130 is formed along another side of the port 110, separated by the first insertion guide 120 by an insertion region 125. As will be evident, the insertion guides 120, 130 provide a ready reference for an installer to insert the sensor 200 (see Figure 3) into the port 110 according to the invention. Second insertion guide/removal stop 130 also extends above the surface 116 of the port 110.

[0021] A third raised portion of the manifold 100, in the form of a rotation stop 140, is positioned circumferentially further around the port 110 from the second insertion guide/removal stop 130. The rotation stop 140 also extends from the manifold 100 further than the face 116 of the port 110. A locking region 135 is defined between the rotation stop 140 and the removal stop 130.

[0022] Referring now to Figure 3, the sensor 200 according to the invention includes an insertion portion 210 for insertion into the port 110, and an external portion 230 including a connection interface 235 for attachment of an external connector such as a wire connector 250(see Figure 8).

[0023] The insertion portion 210 is cylindrical and sized for ready insertion into port 110. An o-ring 218 is provided on the insertion portion to form a seal between the insertion portion 210 and the port 110. A pair of lugs 212, 214 are formed on the end of the insertion portion 210, and extend radially outwardly from a longitudinal axis of the cylindrical insertion portion 210. The lugs 212, 214 are each shown as spanning an arc of approximately 90 degrees of the circumference of the insertion portion 210, and are configured to cooperate with the lugs 112, 114 found in the port 110 for retaining the sensor 200 in the port 110. A leading edge 213, 215 of each lug 212, 214 is shown as being tapered or ramped to allow for the lugs 112, 114, 212, 214 to readily slide over one another.

[0024] With reference now to Figures 4-7, the sensor 200 is aligned over the port 110 so that the insertion portion 210 can be inserted into port 110 in the longitudinal or axial direction. The external portion 230 is aligned over the insertion region 125, preferably abutting the insertion guide 120. The lugs 112, 114 in the port 110, and the lugs 212, 214 on the insertion portion 210 of the sensor 200, are arranged so that when the external portion 230 of the sensor 200 is aligned in the insertion region 125, the lugs do not interfere with the full insertion of the insertion portion 210 into port 110.

[0025] With the insertion portion 210 fully inserted in port 110, external portion 230 will be flush against surface 116 and substantially against insertion guide 120, as shown in Figure 5. Lugs 212, 214 will be circumferentially positioned between lugs 112, 114, but will have passed between lugs 112, 114 so as to be positioned further inside port 110. Thus, as sensor 200 is rotated about the longitudinal axis of insertion portion 210 to a locking position (see Figure 6), lugs 212, 214 will be trapped behind lugs 112, 114.

[0026] Once inserted fully into port 110, sensor 200 can be rotated from the insertion region 125 to the locking region 135. Second insertion guide/removal stop 130 is spaced from port 110 a sufficient distance that external portion 230 of sensor 200 can pass closely to its inside surface. The sensor 200 can only rotate until external portion 230 abuts rotation stop 140. At this point in the rotation, lugs 112, 114, 212, 214 are substantially engaged to retain sensor 200 within port 110.

[0027] Referring now to Figure 8, the sensor 200 is connected to an external system for receiving output from the sensor. As shown, a conventional locking cable connector 250 is removably attached to the connection interface 235 of external portion 230. With the cable

connector 250 attached, the sensor 200 cannot be rotated back to the insertion region 125 for removal, as the attached cable connector 250 extends beyond the external portion 230 so as to interfere with rotation through the second insertion guide/removal stop 130. The sensor 200 is therefore rotationally trapped between removal stop 130 and rotation stop 140. If the sensor 200 requires removal for service or replacement, the cable connector 250 can be removed and the external portion 230 of the sensor 200 rotated to the insertion region 125, wherein the lugs 112, 114, 212, 214 will be clear from one another to allow for removal of sensor 200.

[0028] While the invention has been described in the specification and illustrated in the drawings with reference to a preferred embodiment, it will be understood by those skilled in the art that various changes may be made and equivalents may be substituted for elements thereof without departing from the scope of the invention as defined in the claims. In addition, many modifications may be made to adapt a particular situation or material to the teachings of the invention without departing from the essential scope thereof. Therefore, it is intended that the invention not be limited to the particular embodiment illustrated by the drawings and described in the specification as the best mode presently contemplated for carrying out this invention, but that the invention will include any embodiments falling within the scope of the appended claims.